A comparison of débridement with and without anconeus muscle flap for treatment of refractory lateral epicondylitis

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Background: Lateral epicondylitis is a common condition encountered by orthopedic surgeons. Whereas the majority of patients improve with conservative management, a small percentage will require surgery. The purpose of this study was to compare the clinical outcomes of surgical débridement of the common extensor origin alone with débridement combined with rotation of an anconeus muscle flap in patients who failed to respond to conservative management of chronic lateral epicondylitis.

Methods: Fifty-seven patients who failed to respond to a minimum of 5 months of conservative treatment for lateral epicondylitis were retrospectively reviewed. Patients in group 1 were treated with open débridement of the common extensor origin. Patients in group 2 were treated with open débridement combined with rotation of an anconeus muscle flap. Outcome measures included elbow range of motion, grip strength, visual analog scale (VAS) for pain score, and Disabilities of the Arm, Shoulder, and Hand (DASH) score. Statistical analyses were performed by Student’s t test with 95% confidence intervals.

Results: At final follow-up, average DASH scores were significantly lower in group 2. There were no significant differences between the groups with regard to elbow range of motion or grip strength. VAS pain scores were significantly reduced in both groups. Preoperative VAS pain scores were significantly greater in both groups. Preoperative VAS pain scores were significantly greater in group 2; however, at final follow-up, there was no significant difference between groups. There were no apparent complications in either group.

Conclusions: In addition to débridement of the common extensor origin, the rotation of an anconeus muscle flap may improve outcomes in cases of lateral epicondylitis that require operative intervention.

Level of evidence: Level III, Retrospective Cohort Design, Treatment Study.

Keywords: Lateral epicondylitis; tennis elbow; anconeus; common extensor; muscle flap; rotation flap

Lateral epicondylitis is a common condition encountered by orthopedic surgeons. It is estimated to affect 1% to 3% of adults per year, and approximately half of these patients will seek medical attention. The majority of
patients improve with conservative management after 6 to 12 months,\(^4,6\) even with minimal treatment.\(^9,17\) Several studies have demonstrated that only 4% to 11% of patients will fail to respond to nonoperative treatment and require surgery.\(^4,5,13\) Whereas in highly complex referral practices as many as 25% of patients may be operative candidates, it is estimated that <5% of patients with lateral epicondylitis seen in a general orthopedic practice will go on to require operative intervention.\(^10\)

Traditionally, the operative procedures for lateral epicondylitis have been divided into 5 groups: division of the extensor origin, excision of pathologic tissue at the extensor carpi radialis brevis origin, denervation of the lateral epicondyle, radial nerve decompression, and various intra-articular procedures.\(^18\) More recently, arthroscopic débridement has been described.\(^3,12\) In 1998, Almquist et al.\(^7\) reported on the use of wide excision of degenerative tissue and anconeus flap coverage, with promising results. The purpose of this study was to compare the clinical results of débridement of the common extensor origin alone with débridement combined with anconeus flap coverage in patients who failed to respond to conservative management of chronic lateral epicondylitis.

**Materials and methods**

Patients surgically treated for lateral epicondylitis during a 13-year period were retrospectively reviewed. Operative indications were uniform between both groups. These included persistent pain and tenderness over the lateral epicondyle with the inability to perform work or activities of daily living. All patients failed to respond to a minimum of 5 months of conservative treatment. No patient had any prior surgical intervention. The indication to use an anconeus flap was a denuded lateral epicondyle characterized by soft tissue atrophy and thin, friable skin (Fig. 1). This presentation was typically seen in patients who had undergone multiple corticosteroid injections. Patients indicated for an anconeus flap demonstrated severe tenderness over the lateral epicondyle in addition to tenderness over the common extensor tendon. In patients with a healthy soft tissue envelope over the lateral elbow without significant fat atrophy, a common extensor origin débridement alone was performed. Patients indicated for open débridement of the common extensor tendon demonstrated mild to moderate tenderness over the lateral epicondyle.

Two groups were designed. Patients in group 1 were treated with open débridement of the common extensor origin as described by Nirschl and Pettrone.\(^13\) Patients in group 2 were treated with open débridement in addition to rotation of an anconeus muscle flap to cover the defect. On the basis of a retrospective review of preoperative clinic notes, we looked at sex, age at time of surgery, duration of symptoms, number of corticosteroid injections, length of follow-up, and postoperative complications. In our retrospective review of postoperative clinic and physical therapy notes, objective assessments included elbow range of motion (ROM) and grip strength with the elbow flexed and extended; subjective assessments included pain visual analog scale (VAS) scores from 1 to 10 as well as Disabilities of the Arm, Shoulder, and Hand (DASH) scores at final follow-up.

![Figure 1](https://via.placeholder.com/150)

**Figure 1** Significant fat atrophy surrounding lateral epicondyle secondary to multiple corticosteroid injections.

**Surgical technique for group 1**

The technique for open débridement of the common extensor origin is similar to that described by Nirschl and Pettrone.\(^13\) Under tourniquet control, a 5-cm incision is made over the lateral epicondyle extending distally over the common extensor origin. The deep fascia over the common extensor origin is exposed and incised with a scalpel. The extensor carpi radialis longus is retracted anteriorly, exposing the origin of the extensor carpi radialis brevis. Examination of the extensor carpi radialis brevis tendon origin usually reveals mucoid degeneration with or without a complete tear. The degenerative tissue is sharply excised. If any degeneration is seen involving the extensor carpi radialis longus or the anterior border of the extensor digitorum communis, this is also excised. The interface between the extensor carpi radialis longus and the anterior border of the extensor digitorum communis is then closed side to side with a running absorbable suture. The subcutaneous and skin layers are then closed with absorbable sutures and Steri-Strips.

**Surgical technique for group 2**

The surgical technique of open débridement and anconeus flap coverage is similar to that described by Almquist et al.\(^2\) The anatomy and vascular supply of the anconeus muscle have been well described by Schmidt et al.\(^16\) Under tourniquet control, a 5-cm lateral incision is made over the epicondyle and carried distally toward the insertion of the anconeus muscle on the ulna. Subcutaneous dissection is carried out to expose the anconeus muscle from its origin on the lateral epicondyle to its insertion on the ulna. After the anconeus is exposed, débridement of the common extensor origin is carried out as described for patients in group 1. The anconeus is then sharply elevated from its insertion distally on the ulna. By dissection from a distal to proximal direction, the muscle is elevated off the ulna. The anconeus is then
rotated into the defect created by the excision of the degenerative tissue from the common extensor origin and sutured into place with absorbable sutures. The flap is loosely inset with 2 sutures placed 1 cm distal to the tip of the flap and secured anteriorly to the epicondyle, thus providing coverage of the common extensor repair and the bone (Fig. 2). The tourniquet is then released and the vascularity of the muscle evaluated. The subcutaneous and skin layers are closed with absorbable sutures and Steri-Strips.

**Postoperative protocol**

Postoperative protocols were the same in both groups. Patients were initially placed in a soft bulky dressing and sling for 5 to 7 days. Elbow ROM was started after 5 to 7 days, but strengthening and resistive activities were avoided for a period of 6 weeks. After 6 weeks, gradual strengthening and return to activity were initiated.

**Statistical analysis**

All statistical analyses were performed by Student t test with 95% confidence intervals (P < .05) with one exception: within each group, preoperative and postoperative VAS pain scores were compared by a matched-pairs t test with 95% confidence intervals (P < .05).

**Results**

**Patient characteristics**

Fifty-seven patients met our inclusion criteria. There were 27 patients in group 1 and 30 patients in group 2. Table I denotes the average age, duration of symptoms, number of injections, and average follow-up for the study population. In group 1, there were 14 women and 13 men. In group 2, there were 16 women and 14 men. Conservative treatment varied among patients, but modalities included activity modification, physiotherapy, counterforce bracing, nonsteroidal anti-inflammatory medication, and corticosteroid injections. Twenty-three patients in group 1 and 25 patients in group 2 received injections during their course of treatment. The overall average length of follow-up was 7.1 months (range, 0.5-24 months); the average age at time of surgery was 48.4 years (range, 31-63 years). There were no significant differences between the 2 groups in regard to length of follow-up and average age at time of surgery (Table I). Although on average patients in group 2 had a longer duration of symptoms and received a greater number of corticosteroid injections, these differences were not statistically significant (Table I).

**ROM**

Elbow ROM was available at final follow-up in all 27 of the patients in group 1 and 27 patients in group 2. There were no differences between groups for flexion and extension (Table II).

**Grip strength**

Grip strength of 10 patients in group 1 and 11 patients in group 2 was measured at final follow-up by a Jamar dynamometer (Patterson Medical, Warrenville, IL, USA) with the elbow flexed and extended. There were no differences between groups for grip strength with the elbow flexed or extended (Table II), and grip strength with the elbow flexed was not statistically different from grip strength with the elbow extended in either group 1 (P = .69) or group 2 (P = .94).

**VAS pain scores and DASH scores**

Preoperative VAS pain scores were available for 15 patients in group 1 and 21 patients in group 2. These averaged 4.6 (range, 1-10) in group 1 and 6.7 in group 2 (range, 3-10). The difference was statistically significant (P = .008). VAS pain scores at final follow-up were available for 26 patients in group 1 and 28 patients in group 2. There was no difference between groups for mean VAS pain score at final follow-up (Table II). In the 15 patients in group 1 for whom both preoperative and postoperative data were available, there was a statistically significant decrease in VAS pain scores (P < .001). Similarly, in the 20 patients in group 2 for whom both preoperative and postoperative data were available, there was a statistically significant decrease in VAS pain scores (P < .001). Nevertheless, there was not a statistically significant difference in the mean decrease in VAS pain score between group 1 and group 2 in those patients for whom preoperative and postoperative data were available (P = .09). The frequency of patients reporting no pain at final follow-up was 38% in group 1, 29% in group 2, and 33% overall.

**Figure 2**  The anconeus muscle flap has been elevated off its insertion on the ulna and rotated over the defect in the common extensor origin. The left side of the photograph is proximal and the right side is distal.
DASH scores at final follow-up were available for 14 patients in group 1 and 21 patients in group 2. The mean DASH score of group 2 was significantly lower than the mean DASH score of group 1 (Table II).

**Complications**

We did not note any complications in our study. There were no infections, and no patient required any further surgery. One patient in group 1 was excluded from the study because of reinjury in a motor vehicle accident with litigation pending at the time of evaluation.

**Discussion**

Our results agree with those of previous studies that have shown that patients who undergo débridement of the common extensor origin exhibit improvement but not necessarily elimination of elbow pain. Our results further suggest that the addition of an anconeus muscle flap is associated with slightly superior functional outcomes.

In concordance with the literature, our study suggests that surgical débridement of the common extensor origin may reduce but not eliminate elbow pain. Nirshcl and Pettrone\(^\text{13}\) reported a 97.7% rate of improvement in their series of patients who underwent débridement of the common extensor origin. However, this figure is based on subjective assessment and does not indicate the percentage of patients who were pain free postoperatively. Moreover, results are not uniformly successful. Coonrad and Hooper\(^\text{5}\) reported “generally satisfactory” results after open débridement and repair of the common extensor origin in 39 patients. Nine of these patients still reported transient soreness at final follow-up, which ranged from 1 to 9 years. Nevertheless, this study remarkably reports a complete resolution of pain and full return to preoperative activities. Perhaps the extensive length of follow-up contributed to the high long-term success rate of this study; however, subsequent studies have reported lower rates of complete symptom relief and return to full function in patients observed for only 1 year postoperatively. In a series of 63 patients treated surgically for lateral epicondylitis, Verhaar et al\(^\text{18}\) reported that only 40% of patients were pain free at 1 year after surgery. Twenty-four percent of patients described moderate or severe pain at 1-year follow-up. At final follow-up, 37% of patients still had persistent pain on the lateral side of the elbow, and 12% of patients were still on disability because of symptoms pertaining to the elbow. Rosenberg and Henderson\(^\text{15}\) reviewed the outcomes of 19 patients treated with open débridement and repair of the common extensor origin. The authors reported that 6 of 10 patients involved in sports with a high-demand use of the affected arm either stopped or changed sports. In addition, 2 patients with occupations requiring repeated forearm activity changed jobs after surgery. Baker et al\(^\text{3}\) assessed the outcome of arthroscopic release for lateral epicondylitis. The authors found that 37 of 39 elbows were “better” or “much better” at final follow-up. However, only 25% of patients had complete elimination of elbow pain. In our study, one third of patients enjoyed complete pain relief, a figure that falls within the range reported in the literature. Nevertheless, it is impossible to directly compare our results with those of previous studies because of our shorter duration of and wide variability in length of follow-up. Furthermore, differences in preoperative patient characteristics across studies and the introduction of an additional surgical procedure in our study both limit comparison of our results with previously reported data.

### Table I
Average age, duration of symptoms, number of injections, and follow-up for the study population

<table>
<thead>
<tr>
<th></th>
<th>Age in years (range)</th>
<th>Duration of symptoms in months (range)</th>
<th>No. of corticosteroid injections (range)</th>
<th>Follow-up in months (range)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1 (débridement)</td>
<td>49.5 (31-63)</td>
<td>21.4 (6-48)</td>
<td>3.1 (0-9)</td>
<td>7.3 (0.5-24)</td>
</tr>
<tr>
<td>Group 2 (anconeus flap)</td>
<td>47.5 (34-61)</td>
<td>34.3 (4-168)</td>
<td>3.4 (0-20)</td>
<td>6.9 (1-18)</td>
</tr>
<tr>
<td>P value</td>
<td>.31</td>
<td>.13</td>
<td>.73</td>
<td>.79</td>
</tr>
</tbody>
</table>

### Table II
Elbow range of motion, grip strength, and VAS pain and DASH scores at final follow-up

<table>
<thead>
<tr>
<th></th>
<th>Degrees of elbow extension (range)</th>
<th>Degrees of elbow flexion (range)</th>
<th>Grip strength in flexion, kg (range)</th>
<th>Grip strength in extension, kg (range)</th>
<th>VAS pain score (range)</th>
<th>DASH score (range)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1</td>
<td>1.5 (−10 to 25)</td>
<td>143 (110 to 160)</td>
<td>23 (11-39)</td>
<td>21 (9-39)</td>
<td>2.3 (0-8)</td>
<td>44 (0-62)</td>
</tr>
<tr>
<td>Group 2</td>
<td>4.5 (−10 to 35)</td>
<td>139 (100 to 160)</td>
<td>29 (14-45)</td>
<td>29 (14-41)</td>
<td>2.0 (0-8)</td>
<td>23 (0-61)</td>
</tr>
<tr>
<td>P value</td>
<td>.20</td>
<td>.40</td>
<td>.09</td>
<td>.10</td>
<td>.61</td>
<td>.001*</td>
</tr>
</tbody>
</table>

* Value is statistically significant.
In 1998, Almquist et al\(^2\) described surgical débridement of the common extensor origin in combination with coverage with an anconeus muscle flap for the treatment of persistent lateral epicondylitis. The authors concluded that wide excision with anconeus muscle transfer results in a higher probability of pain relief compared with standard resection in patients undergoing primary surgery for chronic lateral epicondylitis. Luchetti et al\(^{11}\) reported on the outcomes of 13 patients treated with anconeus muscle transfer for either primary chronic lateral epicondylitis (8 patients) or recurrence or infection after prior surgery (5 patients). All 8 patients treated with anconeus flap as a primary procedure reported complete relief of pain and increased grip strength postoperatively. All patients returned to their previous work. The authors noted that the addition of the anconeus flap added only approximately 15 minutes to the operative time, and whereas an understanding of the vascular anatomy of the anconeus muscle is crucial, microvascular experience is not required to perform this procedure. The anconeus flap has also been described in cases for revision of failed primary lateral epicondylitis surgery.\(^{7,16}\)

Almquist et al\(^2\) proposed 3 explanations as to why the anconeus flap may be superior to débridement of the common extensor origin alone. First, a generous resection of degenerative tissue is possible because the defect can be covered. Incomplete excision of degenerative tissue has been linked with failed lateral epicondylitis surgery.\(^{1,4}\) Second, improved results may be related to the padding effect of the muscle flap. Third, more vascular tissue may be brought into the area with the muscle tissue, thus promoting healing.

The findings of our retrospective review are consistent with those of Almquist et al.\(^2\) Compared with débridement alone, débridement of the common extensor origin combined with anconeus muscle flap coverage was associated with significantly better postoperative functional outcome scores. In addition, patients undergoing anconeus flap coverage exhibited a trend toward superior grip strength in both elbow flexion and extension, although neither measure achieved significance. Dorf et al\(^8\) have shown that in patients with lateral epicondylitis, grip strength tends to be more limited with the elbow extended than with the elbow in flexion. Our findings indicate that surgical treatment of lateral epicondylitis may resolve this discrepancy, as grip strength with the elbow flexed was not significantly different from grip strength with the elbow extended in either treatment group. Ultimately, sufficient grip strength alone does not ensure high function. Additional factors, such as pain, may limit the performance of daily activities, and functional outcomes measures such as DASH scores provide further insight.

There was no difference in elbow ROM between the 2 groups at final follow-up. Although not specifically tested in this study, we did not have any patient complain of loss of elbow extension strength after anconeus muscle transfer. Schmidt et al\(^{16}\) looked critically at this and found no differences in extension strength in elbows that underwent anconeus flap compared with normal elbows. Patients do tend to have a subjective fullness over the lateral epicondyle as a result of the flap, but this has not been a cosmetic problem in our experience. Patients are counseled preoperatively that with anconeus flap coverage, they may notice a difference in the fullness of the elbow compared with the contralateral side.

One strength of this study is that we were able to retrospectively compare patients treated with an anconeus flap with a similar cohort of patients treated with débridement alone. Another strength of the study is the availability of postoperative DASH scores for the majority of patients in each group. DASH scores more comprehensively reflect function and ability to perform daily activities than do individual measures such as ROM, grip strength, and pain scores. However, the study has several limitations. It is a retrospective review and therefore carries all the limitations therein. There were relatively few patients in the study, and even fewer patients for whom matched preoperative data exist. This limitation reflects our conservative approach to the operative treatment of lateral epicondylitis. We also present only short-term follow-up. It is possible that the results of the study may have been different with longer follow-up. Furthermore, this study was not randomized; patients were selected for the addition of an anconeus flap on the basis of the subjective assessment of significant atrophy of the soft tissue envelope over the lateral elbow. We suspected that they would have worse outcomes postoperatively compared with patients with a healthier soft tissue envelope, and indeed those patients in the anconeus flap group reported significantly greater preoperative VAS pain scores. However, the subjective selection criteria for patients receiving an anconeus flap may have been in some way protective. With regard to the proportion of patients who were pain free postoperatively, as mentioned previously, the inhomogeneity of follow-up periods within our study limits our ability to compare our results with those of previous studies; in addition, the discrepancy in preoperative VAS pain scores between groups further prevents meaningful comparison within the study itself. Randomized prospective studies with long-term follow-up are warranted.

**Conclusion**

Our study findings suggest that for cases of lateral epicondylitis that fail to respond to conservative management and require operative intervention, the addition of an anconeus flap to débridement of the common extensor origin is associated with slightly superior functional outcome scores, and there is no apparent increased risk of complications associated with this.
procedure. Additional prospective, randomized trials are needed to further assess the role of the anconeus flap in lateral epicondylitis surgery.

Disclaimer

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References